



# Quantification of Thermokarst and Carbon Release

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**Collaborators:**

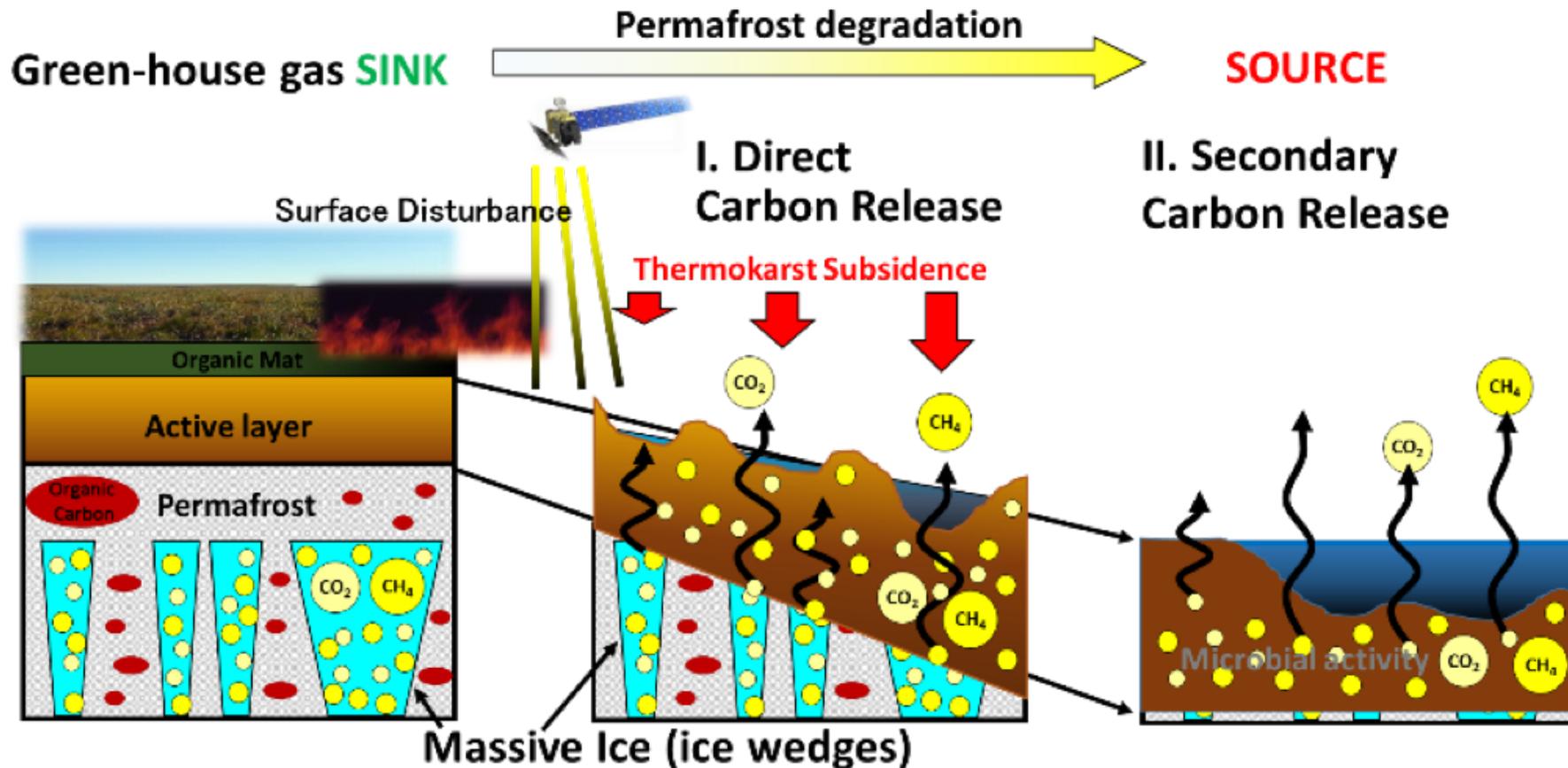
Stan Wullschleger (NGEE, ORNL)

Timothy Kneafsey (NGEE, LBNL)

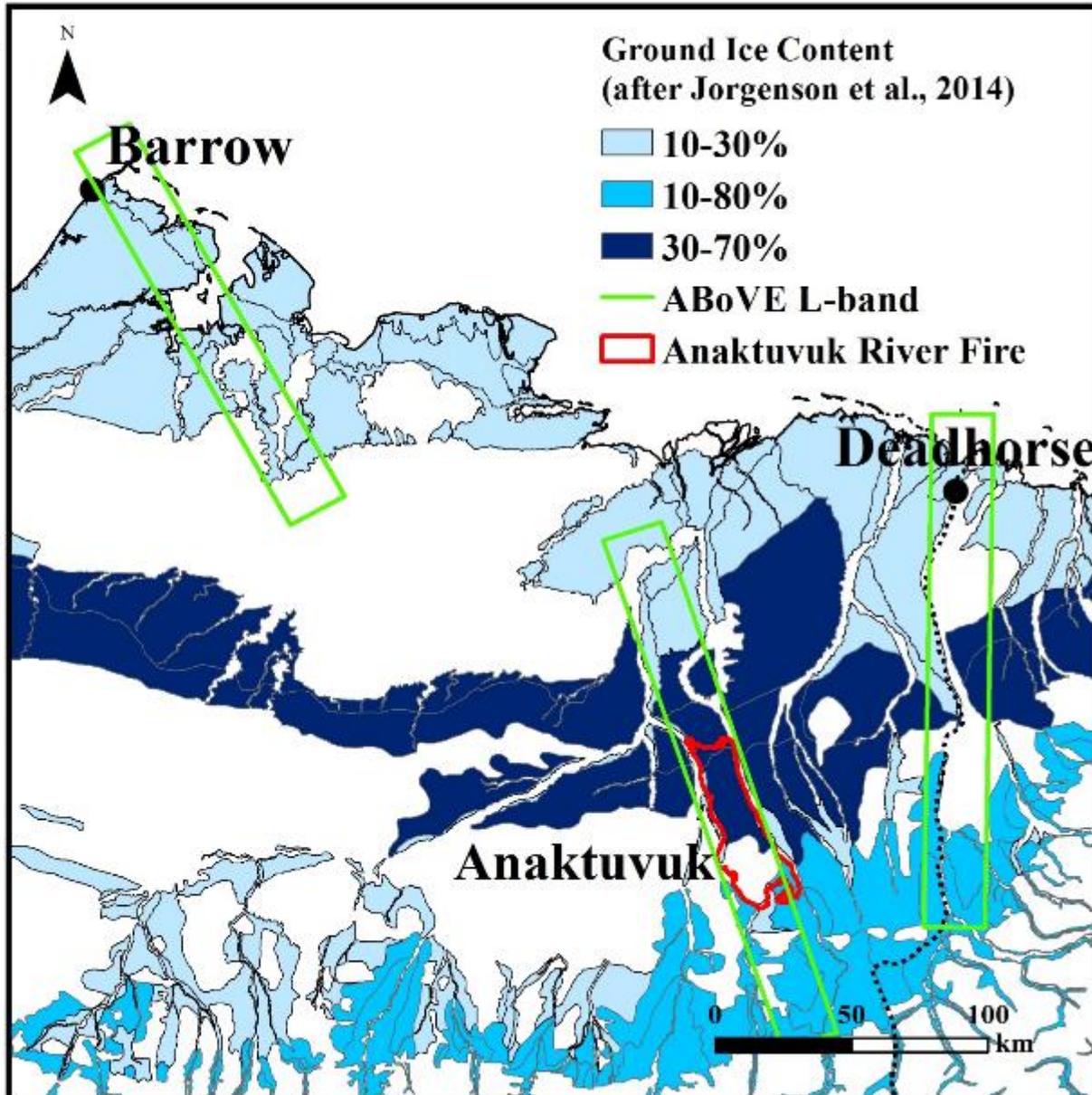
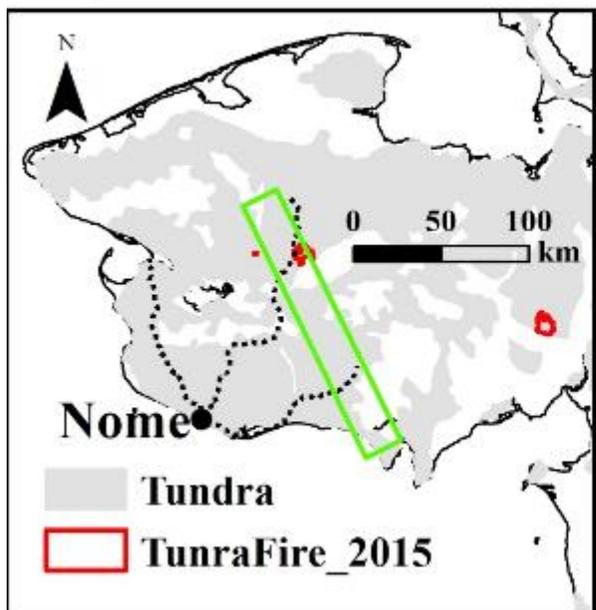
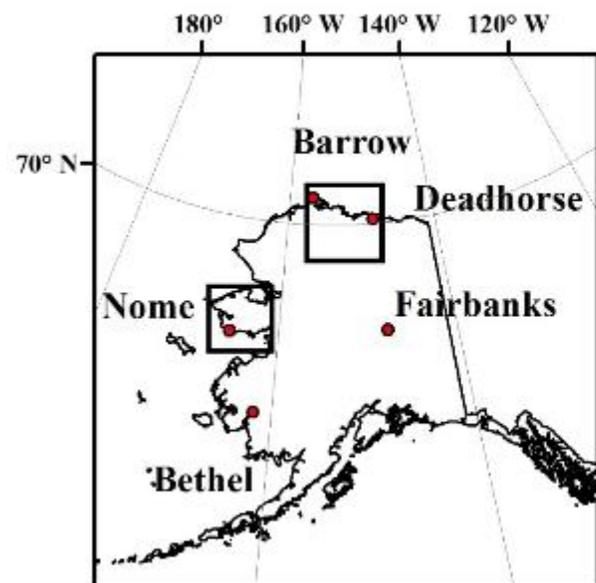
Jinho Ahn (Seoul National Univ.)

# Science Objectives

1. Measure the spatial variation of thermokarst subsidence
2. Reduce uncertainty in thermokarst quantification using remote sensing
3. Estimate GHG and organic matter contents in permafrost
4. Evaluate the rates of potential release of carbon upon thermokarst development (Release I)

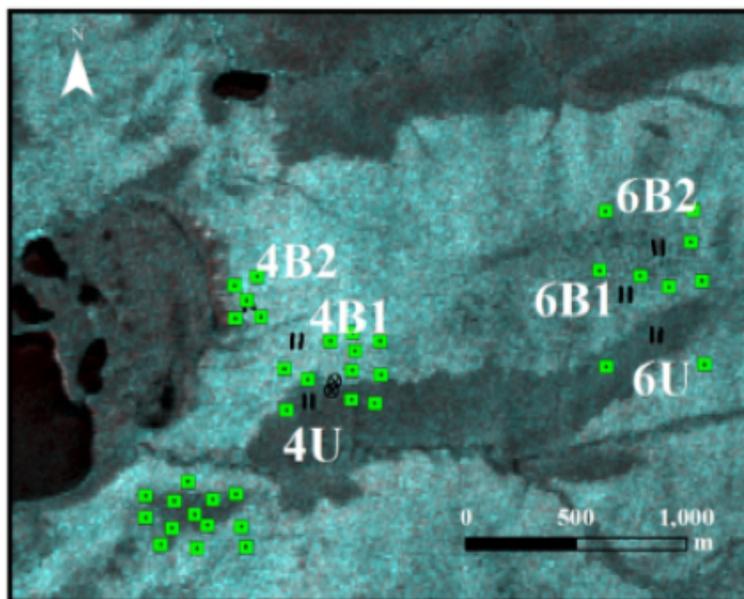
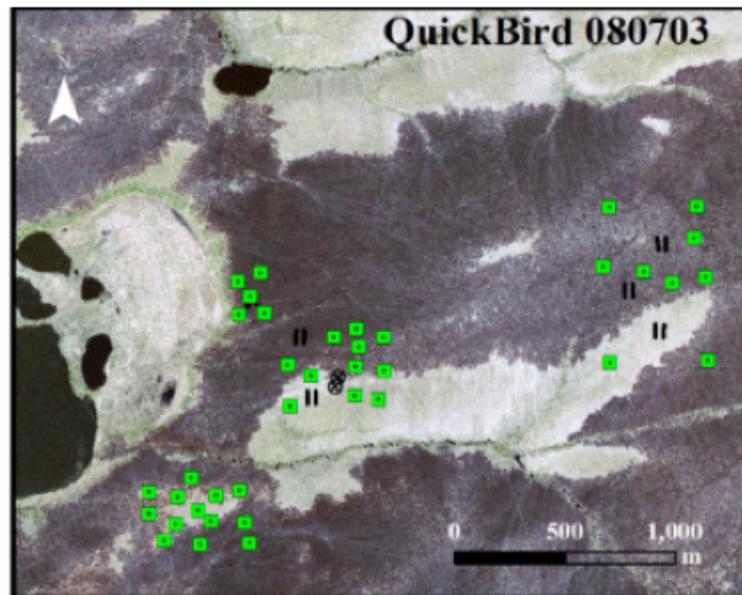
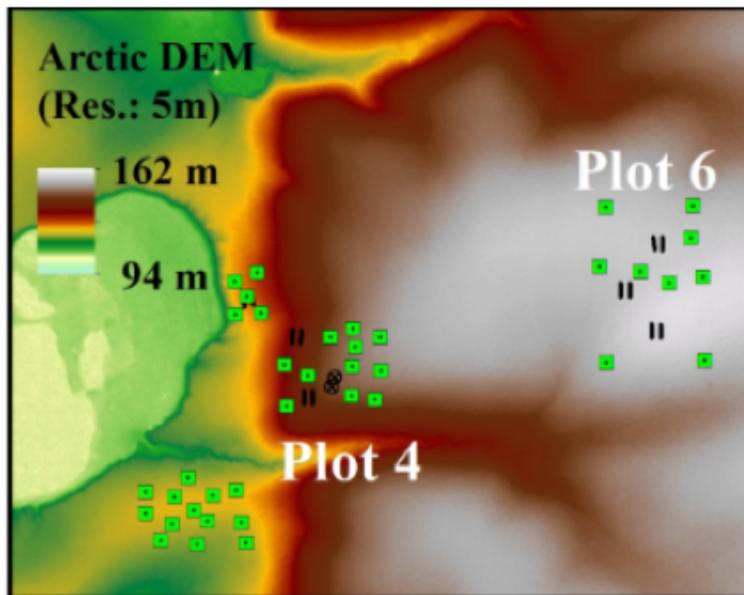


# Focus Areas

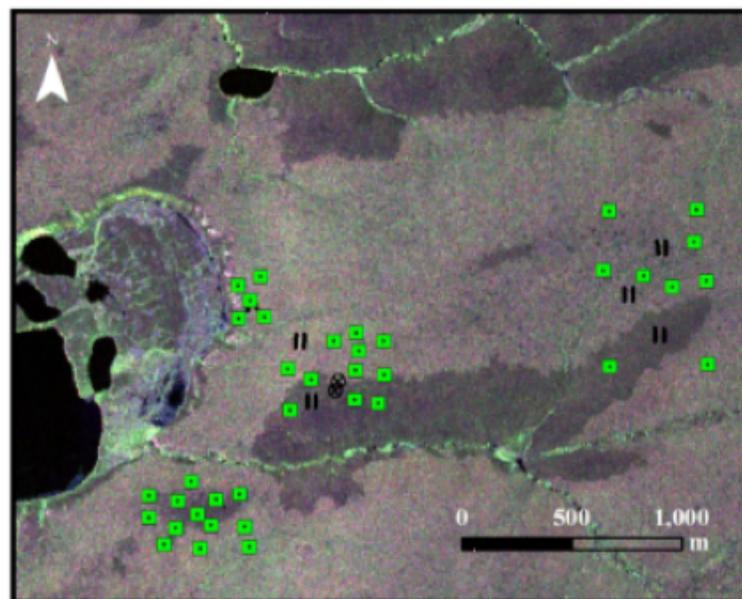


- Barrow BEO
- Dalton HWY
- Anaktuvuk Fire  
burned in 2007
- Kougarok Fire  
burned in 2015

# Anaktuvuk Survey Plots



AirMOSS anaktW 170813



UAVSAR anaktW 170916

- Burned vs. Unburned
- Thermokarst intensity
- Slope

# Anaktuvuk Plot 4

4B2

4B1

Burned

4U

Unburned

Survey contents:

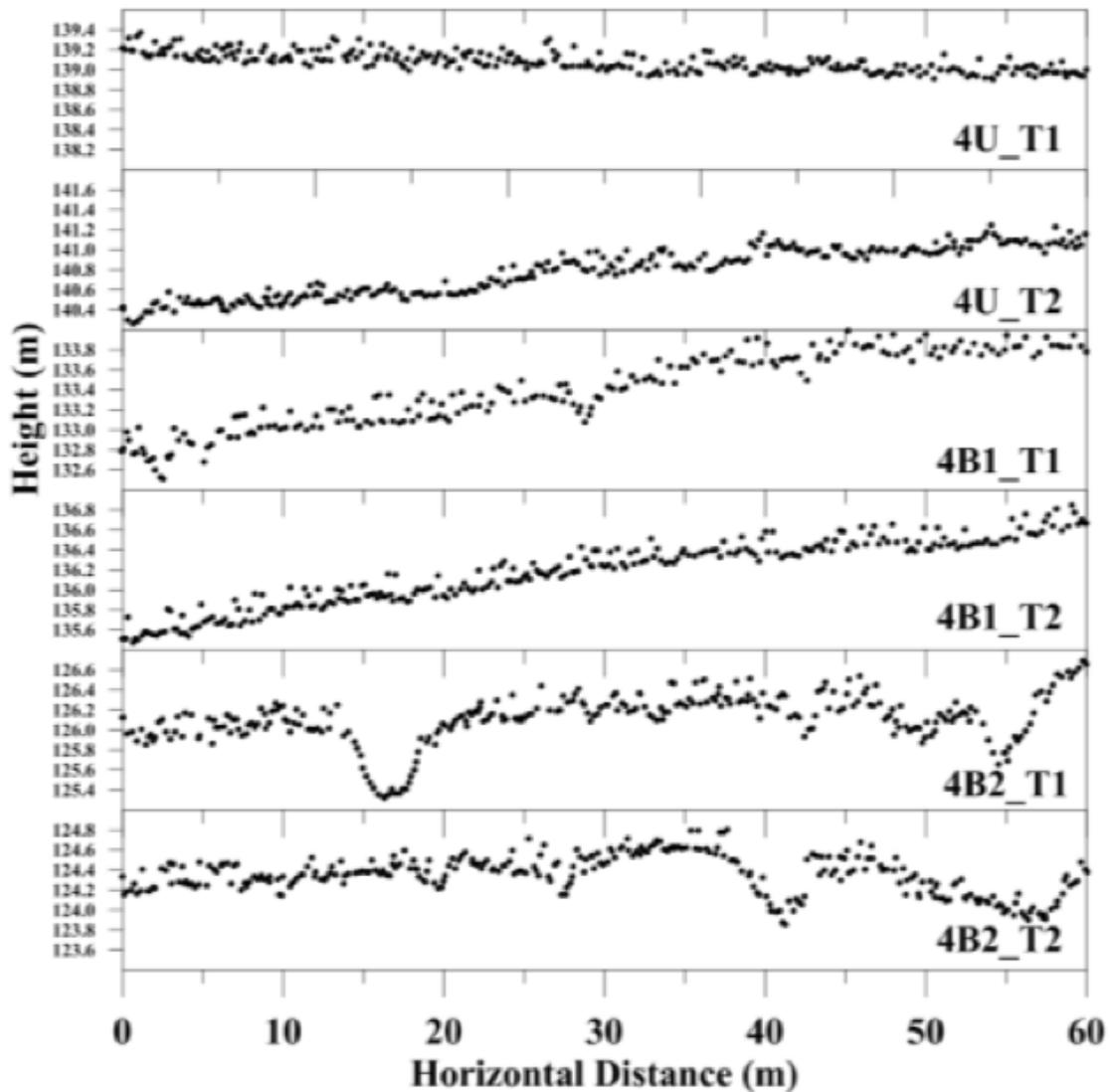
- Micro-topography
- Thaw settlement
- Thaw depth
- Surface moisture
- Core analyses
- Inter-annual subsidence

Thermokarst intensity

$4U < 4B1 < 4B2$

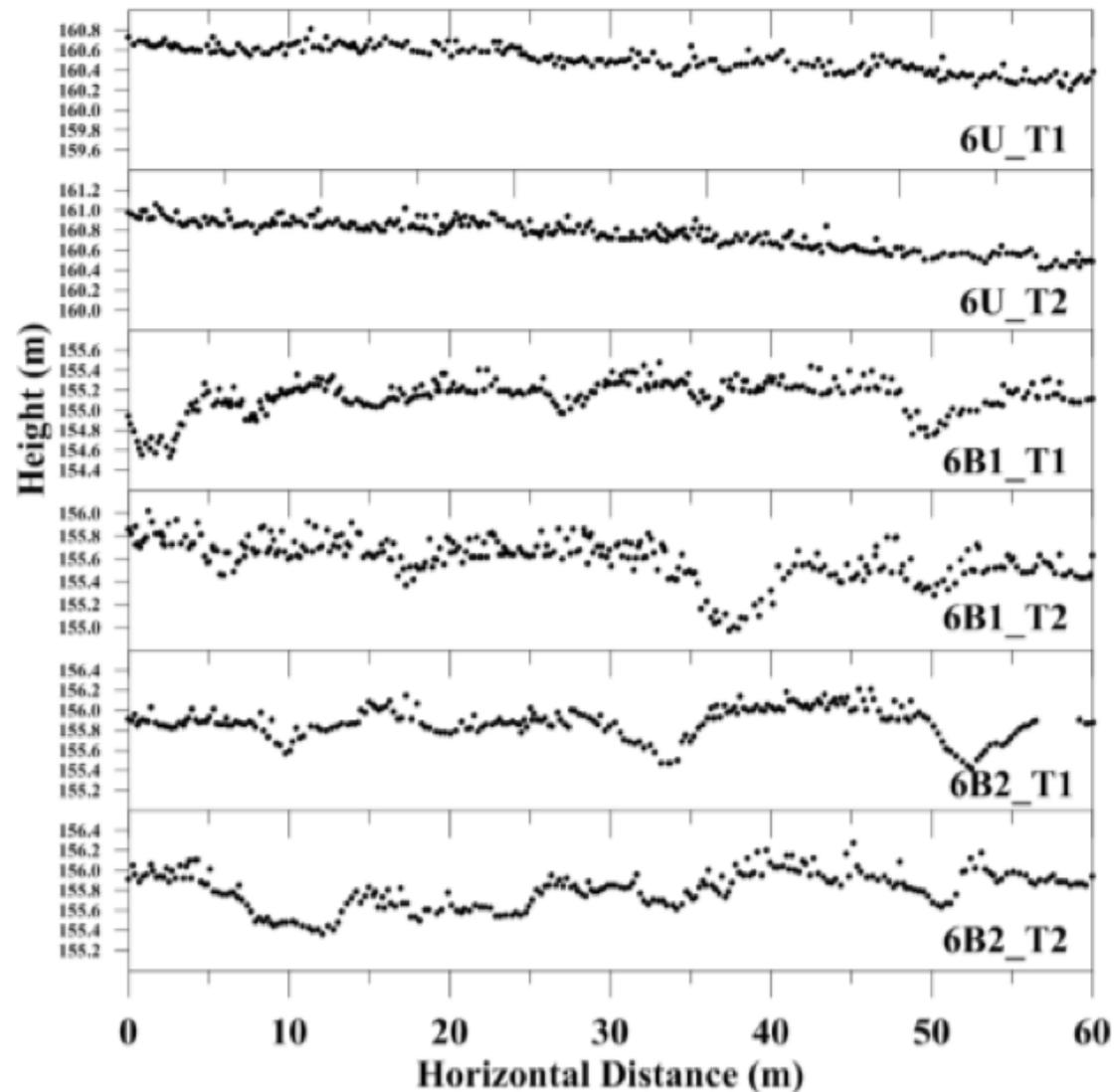
# Micro-topography

Plot 4

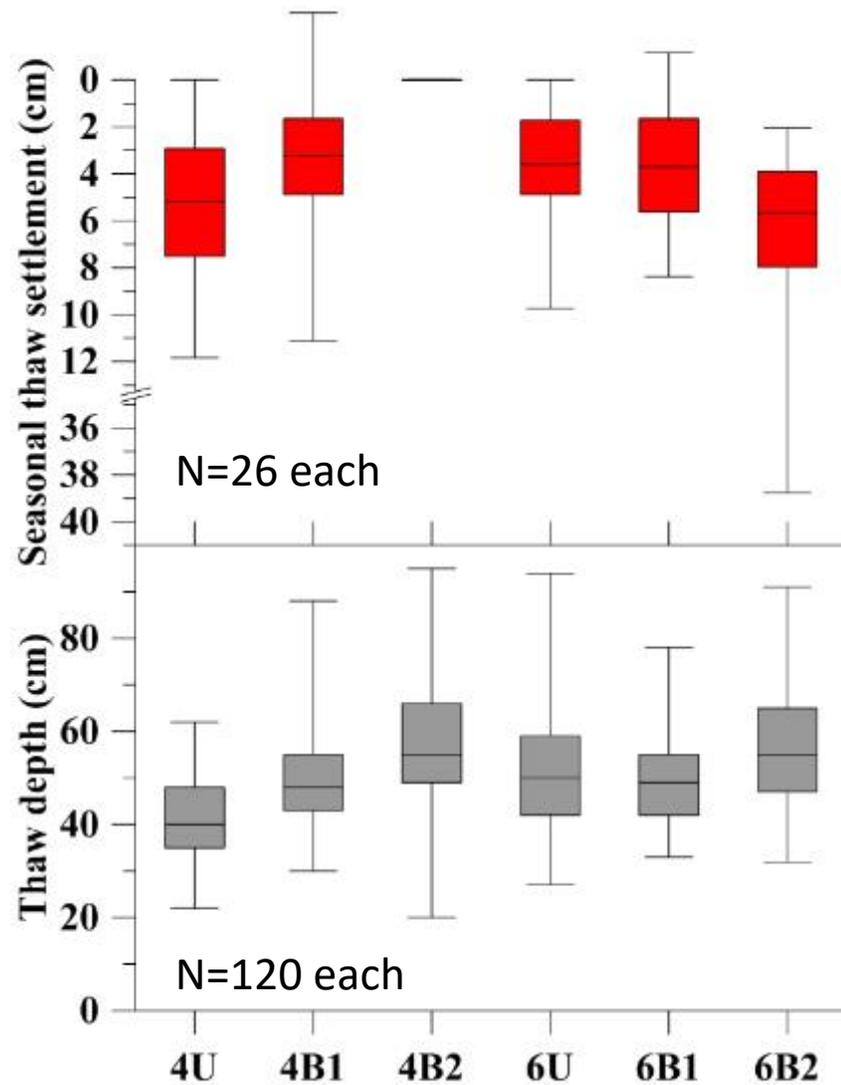


Thermokarst intensity  
 $U < B1 < B2$

Plot 6

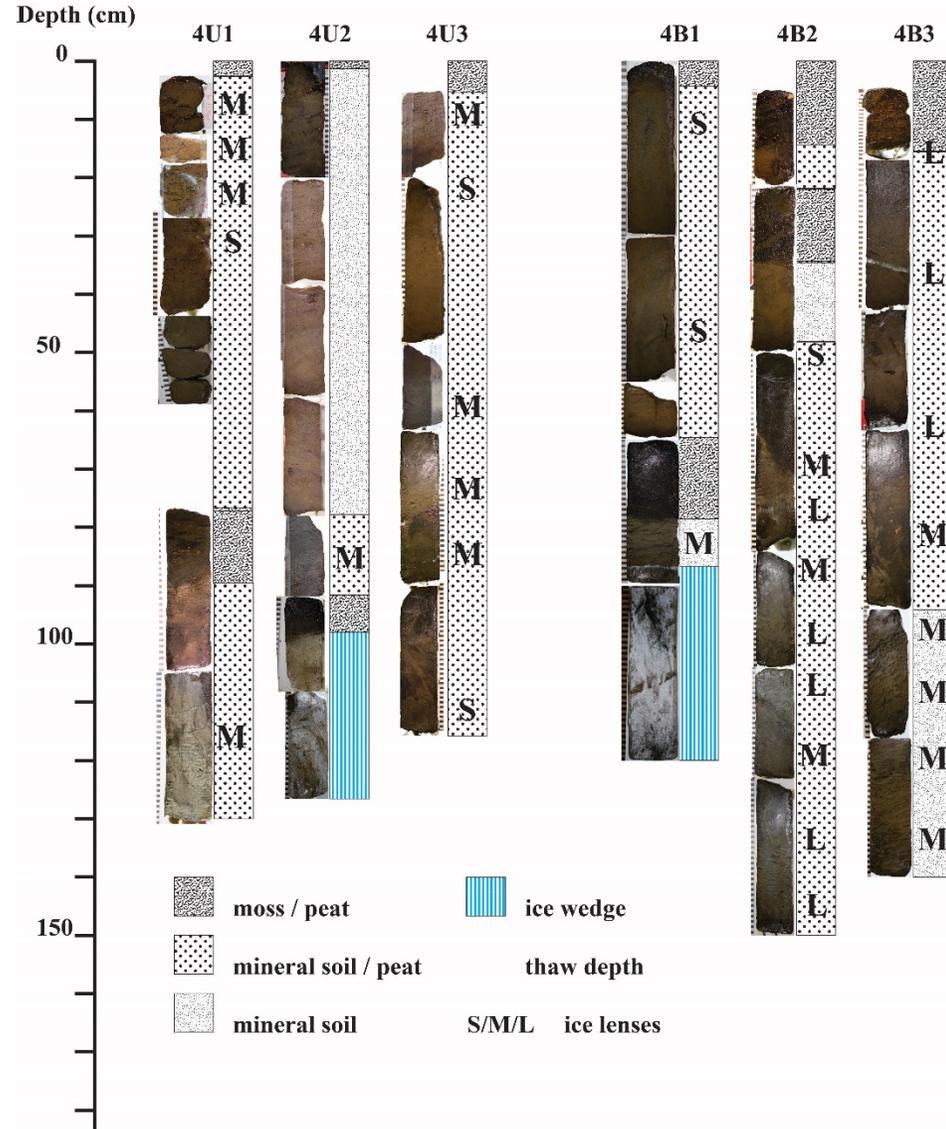


# Thaw settlement, Thaw depth, & Surface moisture



	4U	4B1	4B2	6U		6B1		6B2	
				6cm	12cm	6cm	12cm	6cm	12cm
	<b>08/22/2017</b>								
<b>Ave</b>				32	38	36	38	36	44
<b>Std</b>				14	13	13	13	13	9
<b>Min</b>				5	2	3	7	3	18
<b>Max</b>				52	52	52	59	52	62
<b>Inundation</b>				5	17	35	50	42	64

# Permafrost Core/Block Analyses



- Ice content
- Organic matter content
- CH<sub>4</sub>/CO<sub>2</sub> contents
- Water stable isotopes
- Geochemistry

# Near term plans for analysis/publication

## Remote Sensing Analysis

- Spatial Variation in Thermokarst Subsidence after the Anaktuvuk River Fire

## Core Analysis

- Physical and Geochemical profiles of active layer and near surface permafrost near Barrow.

# Longer-term plans for synthesis and/or multi-sensor analyses

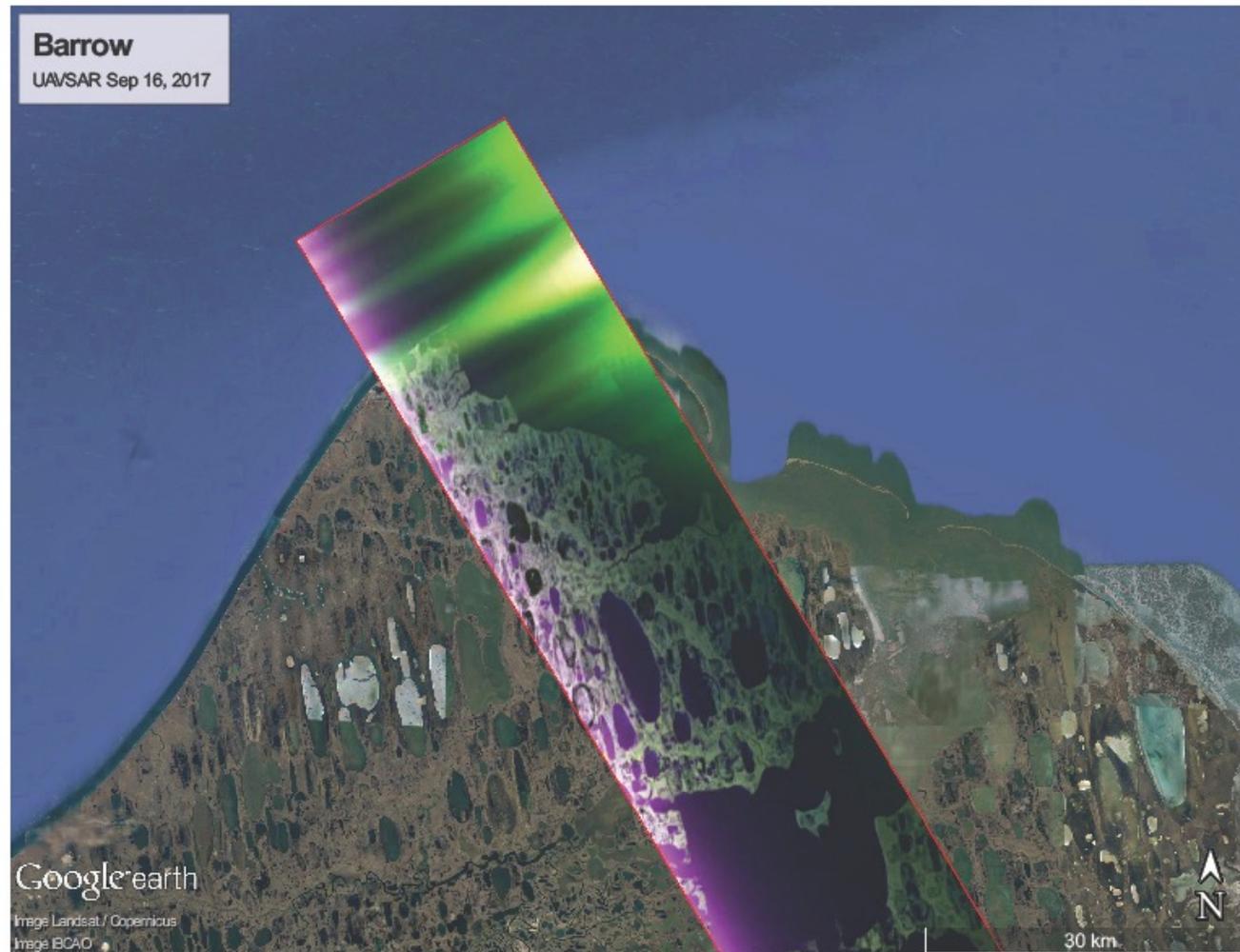
- Remote Sensing of thermokarst subsidence
- Error analyses, Quantification of Volume loss in permafrost / Surface Deformation Processes due to Thermokarst
- using InSAR/Polarimetry of High-Resolution optical imagery, UAVSAR/AirMOSS, RADARSAT2, and ALOS1/2

# Posters for more details

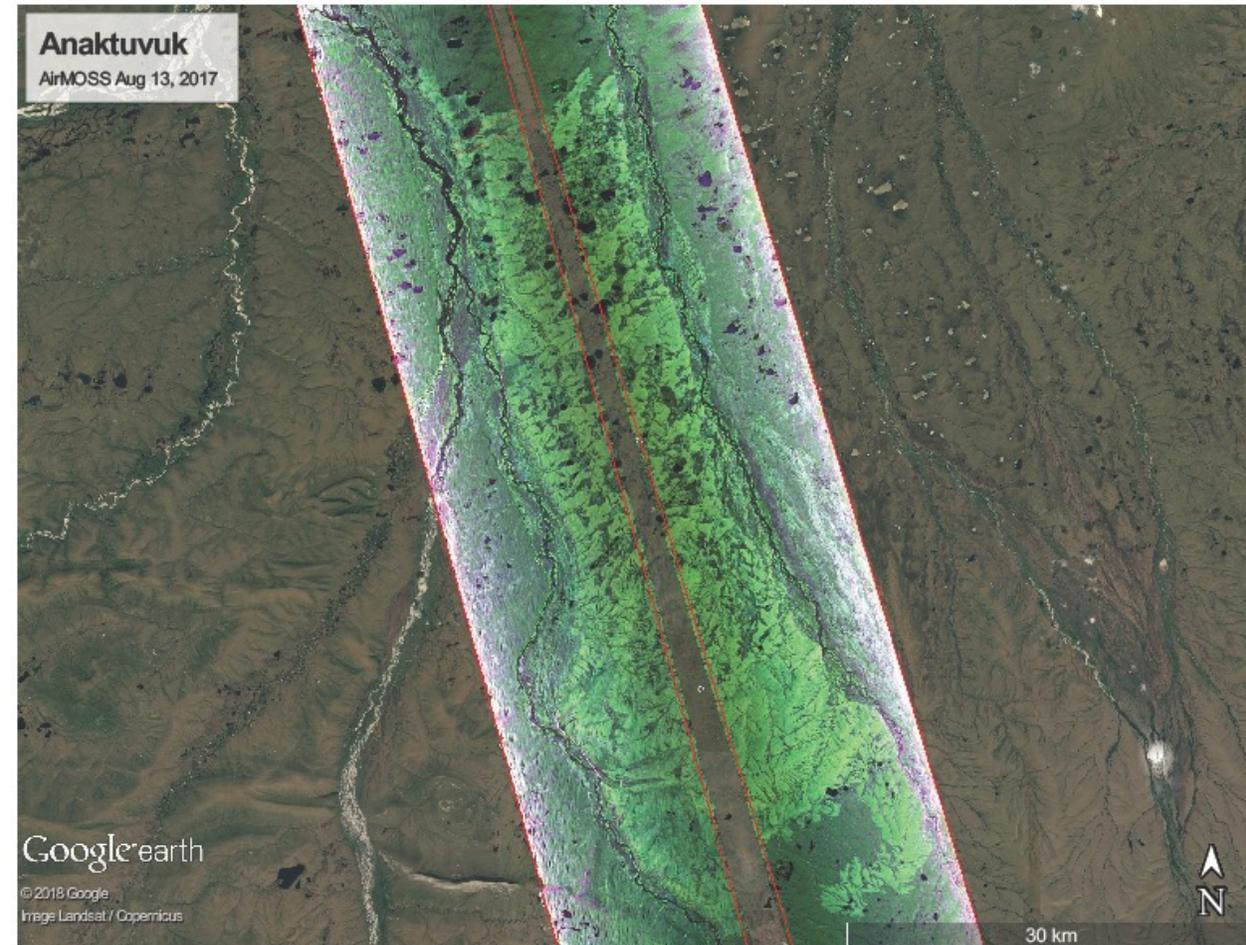
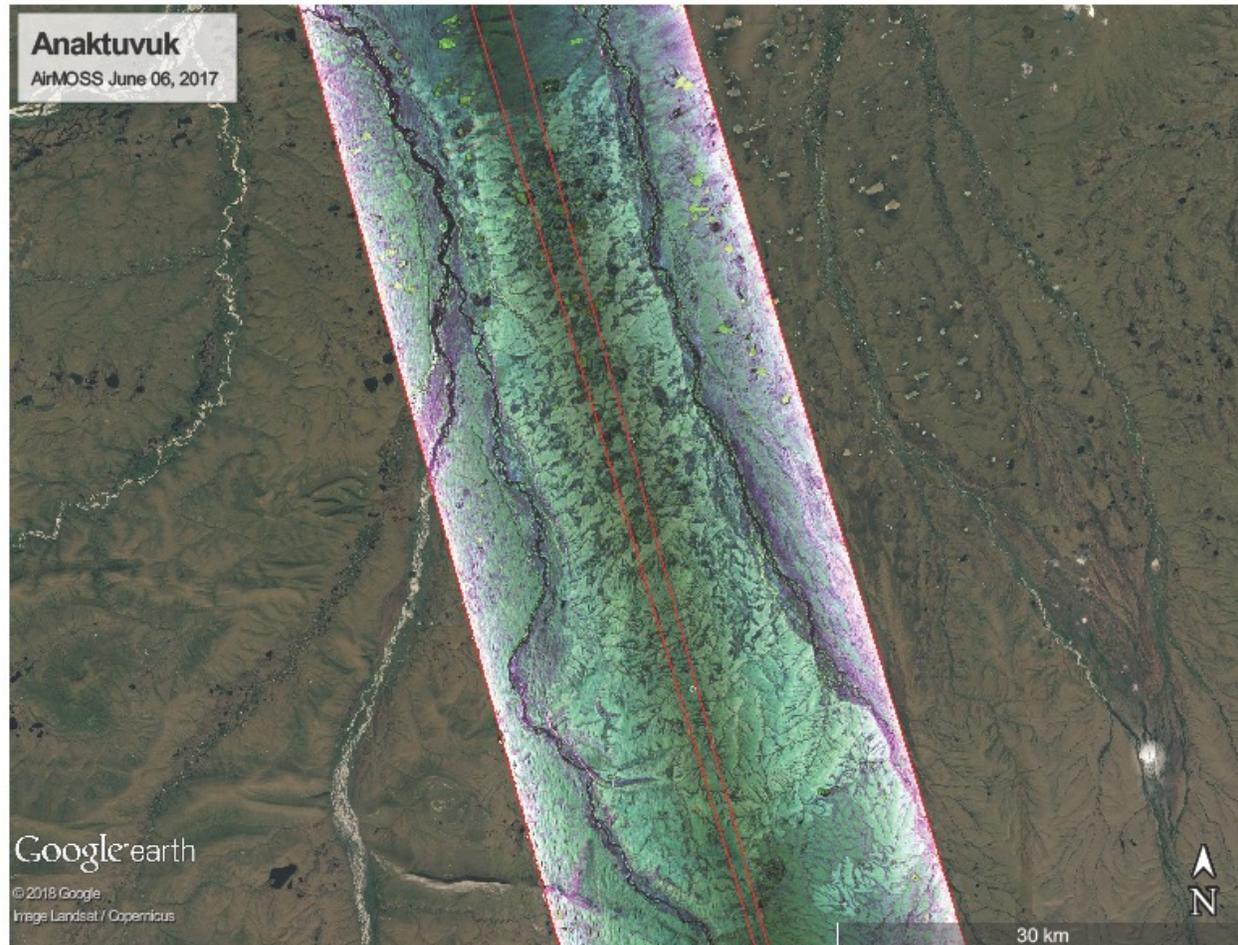
- 2017 and past field campaigns and Overview of AAC data
  - **Go Iwahana**: Quantification of Thermokarst and Carbon Release: Field Surveys
  - **Seungbum Kim**: Dynamic inundation mapping using SMAP and UAVSAR data
- Perspectives to data and error analyses using ABoVE airborne and space-borne SARs
  - **Reginald Muskett**: InSAR Experiments in Arctic Alaska
- Multidisciplinary study in the Anaktuvuk River Fire
  - **Randi Jandt**: Tundra Fire Accelerates De-frosting of America's Icebox



# Artifact in Barrow L-band image



# P-band Flight line shifted: Still capable for interferometry?



# Problem in L-band flight line; Fixable?

